(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING
Volume 8, No. 3, September 2025
P-ISSN 2621-4733
E-ISSN 2621-4741
https://dx.doi.org/10.22460/jiml.v8i3.p27395

THE IMPLEMENTATION OF THINK PAIR SHARE MODEL TO IMPROVE MATHEMATICAL COMMUNICATION ABILITY ON MTS STUDENTS

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ARTICLE INFO

Article history:

Received May 17, 2025
Revised May 22, 2025
Accepted May 26, 2025

Keywords:

Mathematical Communication Ability
Think Pair Share
MTs Students

ABSTRACT

Mathematical communication ability is a crucial aspect of mathematics learning, as it enables students to express ideas, understand concepts, and solve problems systematically. This study aims to analyze the implementation of the Think Pair Share (TPS) learning model on students' mathematical communication skills at Madrasah Tsanawiyah (MTs) level. The research method used is a Mixed Method with an Explanatory Sequential Design. The sample consisted of two classes: the experimental class, which used the Think Pair Share model, and the control class, which used a conventional learning model.The results showed that the mathematical communication skills of MTs students taught using the Think Pair Share model were better than those taught using a conventional model. The N-gain results also indicated that the improvement in communication skills was greater in the Think Pair Share group. This was supported by student statements in interviews, indicating that the Think Pair Share (TPS) model made learning more enjoyable and allowed more freedom in thinking, discussing, and expressing solutions. This contributed to increased communication abilities. Based on the findings, it can be concluded that the implementation of the Think Pair Share learning model results in a statistically significant improvement in students' performance compared to the conventional learning model. Accordingly, the Think Pair Share model may serve as an effective pedagogical alternative for enhancing mathematical communication skills among students at the Madrasah Tsanawiyah (MTs) level. The implementation of this model is expected to be integrated into mathematics instruction as a means of enhancing students communication skills.

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How to Cite:

Syaprila, A.A., & Amelia, R. (2025). The Implementation of Think Pair Share Model to Improve Mathematical Communication Ability on MTs Students. *JIML,* 8(3), 533-542.

INTRODUCTION

Mathematics is a fundamental subject taught from primary to secondary education, reflecting its importance and the necessity for students to develop a strong understanding of it. According to Pertiwi & Novtiar (2022), Mathematics holds a crucial position within the field of science, making it essential for educators to give focused attention to mathematics instruction to ensure its proper evaluation and effective application at every level of education. In the context of

learning mathematics, the cognitive domain encompasses the basic knowledge and abilities that students have acquired. These skills play a fundamental role in enabling students to grasp mathematical concepts and are closely associated with their capacity for mathematical reasoning (Pertiwi & Novtiar, 2022).

A fundamental cognitive component in mathematics is the ability of students to communicate mathematically. According to Greenes & Schulman (Lubis & Rahayu, 2023), Mathematical communication is essential for students to express mathematical concepts and formulate effective strategies. Mathematical communication is also a vital element in tackling and resolving mathematical problems. Additionally, it functions as a channel for students to exchange ideas, identify solutions, and enhance their comprehension of mathematical concepts. This process supports students in reinforcing and structuring their mathematical reasoning, as well as in exploring various mathematical ideas (Dalimunthe et al., 2022).

Based on the statement above, it can be inferred that mathematical communication skills hold a significant role for students. This perspective is corroborated by Sari & Nur (2024), who emphasize that these skills are essential for students to grasp and convey ideas related to specific mathematical subjects, while also promoting the development of reasoning, creativity, critical thinking, and independence. In line with the opinion of Imanisa et al (2023), communication skills play a crucial role in the learning process; therefore, mathematical communication ability is regarded as one of the primary objectives in mathematics education at schools. This ability is essential for students as it supports learning activities both inside and outside the classroom

Based on the aforementioned viewpoints, it can be inferred that developing mathematical communication skills is a fundamental goal in mathematics education. Nonetheless, the communication proficiency of Indonesian students in this domain is still comparatively low. Empirical studies indicate that students face difficulties in expressing concepts through mathematical symbols, determining initial problem-solving steps from given statements, and generally exhibit low motivation toward mathematics learning (Syah & Sofyan, 2021). This aligns with research by Nuraeni (Hanisah & Noordyana, 2022), This indicates that students commonly demonstrate poor mathematical communication skills, both in writing and speaking. This is reflected in frequent misunderstandings of problems, misuse of mathematical symbols, and inappropriate use of mathematical terminology. Additionally, students seldom articulate their mathematical ideas verbally.

Further research carried out at an MTs in Padalarang, West Bandung Regency, revealed that students face challenges in clearly expressing problems or conclusions both verbally and in written form. These results highlight the necessity of adopting alternative methods to improve students' mathematical communication abilities. One promising strategy is the application of a non-traditional instructional approach, specifically the Think Pair Share (TPS) model. According to Maryoto (Tri et al., 2021), The Think Pair Share (TPS) model focuses on collaborative thinking and interaction, allowing students to communicate more effectively with their peers, value different viewpoints, and take ownership of their learning process. Additionally, TPS provides several benefits, including its adaptability to large class settings, opportunities for individual reflection, and designated time for students to develop and articulate their ideas prior to participating in group or whole-class discussions (Lestari & Luritawaty, 2021). In addition, according to Rada et al (2021), the Think Pair Share (TPS) model can enhance students' mathematical abilities, as it encourages them to recall and communicate their understanding to peers within their group. Students share their ideas with one another while collaboratively solving problems with their group members. The Think Pair Share (TPS) learning model also provides opportunities for students to think more independently and respond to the material or questions presented. The implementation of the TPS model encourages students to develop critical thinking skills, reason logically, broaden

their perspectives, and independently find solutions to the problems they encounter (Siregar, 2021)

The Think Pair Share (TPS) model has demonstrated potential in enhancing students' communication abilities, as shown in previous studies. For example, Purba & Rajagukguk (2024) found a significant impact of Think Pair Share (TPS) on students' mathematical communication. Similarly, Simanjuntak et al (2022) and Veronika & Amry (2024) concluded that Think Pair Share (TPS) improves students' communication skills, as evidenced by post-test results.

Based on the aforementioned research findings, the novelty of this study is to analyze the conceptual understanding abilities of MTs students through the implementation of the Think Pair Share (TPS) learning model. It is anticipated that this model will serve as an effective approach by fostering an engaging and stimulating learning environment in mathematics, thereby enhancing students' mathematical communication skills. This is attributed to the method's capacity to enable students to freely explore and articulate mathematical concepts.

METHOD

This study employed a Mixed Methods approach. According to Creswell (Azhari et al., 2023), the Mixed Methods approach combines both quantitative and qualitative research methods. Martens (Subagyo, 2020) defines Mixed Methods research as an approach that involves the collection and analysis of data, integration of findings, and drawing of inferences using both qualitative and quantitative techniques within a single study.

The integration of these two methods is expected to provide a more comprehensive and in-depth understanding of the research problem.

The purpose of this study is to investigate the effect of the Think Pair Share (TPS) learning model on the mathematical communication skills of students at the Madrasah Tsanawiyah (MTs) level. The research design used is the Explanatory Sequential Design, which is appropriate for studies where quantitative data are collected first, followed by qualitative data to explain or elaborate on the quantitative results. The research procedures are outlined in the following diagram:

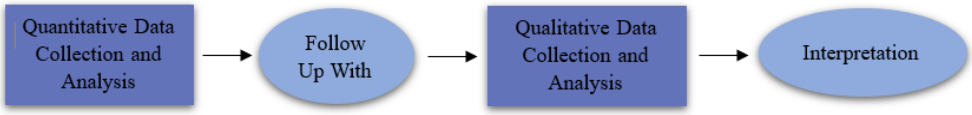

Figure 1. Explanatory Sequential Design

The instruments used in this study consisted of both test and non-test tools designed to obtain comprehensive information about students' mathematical communication skills. The test instruments included a pretest and posttest, while the non-test instrument was an interview. The indicators of mathematical communication ability used in this study are detailed below:

Table 1. Scoring Rubric for Mathematical Communication Skills

No.	Indicator of Mathematical Communication	Question No.	Score
1	Use of mathematical terms, notation, and structure to present ideas, illustrate relationships, and model situations	1 4	10 20

2	Expressing specific situations through mathematical representations (e.g., diagrams, tables, graphs) into symbols, models, or language	2 5	15 20
3	Explaining mathematical relationships in written form based on contextual understanding	3 6	15 20
	SMI		100

The mathematical communication abilities of students in both the experimental and control classes were analyzed to determine whether there were statistically significant differences in posttest results. Data were processed using SPSS, beginning with tests of normality and homogeneity. If the data were normally distributed, an Independent Samples t-test was conducted. Otherwise, the Mann–Whitney U test was used for non-parametric analysis.

RESULTS AND DISCUSSION

Results

This study was conducted at an MTs (Islamic junior high school) located in Padalarang, West Bandung Regency. Data were collected through pretests and posttests administered to two groups: an experimental class (taught using the Think Pair Share model) and a control class (taught using conventional methods). The pretest was administered to assess the student's initial abilities before instruction.

In the experimental group, instruction was delivered according to the stages of the Think Pair Share (TPS) model, whereas the control group was taught using a conventional teaching approach. Upon completion of the instructional period, both groups underwent a posttest to assess their final mathematical communication abilities. The analysis of the pretest data is presented as follows:

Table 2. Pretest Mean Scores

No.	Class	Mean Score
1	Experimental	20.10
2	Control	21.20

The results in Table 2 show that the pretest mean score for the control group was 21.20, while the experimental group scored 20.10. This indicates a slight difference in the initial abilities of the two groups, suggesting that their baseline performance was not significantly different. A normality test was then conducted to determine whether the data were normally distributed. The Shapiro-Wilk test was used with a significance level of 0.05, and the hypotheses were as follows: H_0 indicates that the data are normally distributed, while H_1 indicates that the data are not normally distributed. The testing criteria used were: if the significance value (sign) is $\geq$ 0.05, then H_0 is accepted, meaning the data are normally distributed; if the significance value is < 0.05, then H_0 is rejected, meaning the data are not normally distributed. The results of the Pretest normality test are as follows:

Table 3. Pretest Normality Test Results

Shaphiro-Wilk	Statistic	df	Sig.
Experimental	.831	20	.003
Control	.872	20	.013

Based on the normality test results of the pretest scores using SPSS, the significance values obtained were 0.003 for the experimental class and 0.013 for the control class. Since both

significance values are less than 0.05, the null hypothesis (H0) is rejected. This indicates that the data from both classes are not normally distributed. Therefore, the analysis will proceed with the Mann-Whitney test to determine whether there is a difference in the average initial abilities between the experimental and control classes. The test was conducted using SPSS with a significance level of 0.05, and the hypotheses formulated are:

H_0: $\mu 1 = \mu 2$ (There is no difference in the average initial ability between the Experimental Class and the Control Class)

H_1: $\mu 1 \neq \mu 2$ (There is a difference in the average initial ability between the Experimental Class and the Control Class)

The testing criteria are as follows: if the significance value (sig.) ≥ 0.05, H0 is accepted; if the significance value (sig.) < 0.05, H0 is rejected. The results of the Mann-Whitney test are as follows:

Table 4. Mann–Whitney U Test Results – Pretest

Test Statistics[a]	
Mann-Whitney U	168.000
Wilcoxon W	378.000
Z	-.877
Asymp. Sig (2- tailed)	.381

The significance value of $0.381 > 0.05$ means H_0 is accepted, indicating no significant difference in the students' initial abilities between the two groups. Following this, the Think Pair Share (TPS) model was implemented in the experimental class, while the control class continued with conventional instruction. Both groups were then given the posttest. The average Posttest results are as follows:

Table 5. Posttest Mean Scores

No.	**Class**	**Mean Score**
1	Experimental	64.35
2	Control	52.10

The posttest results reveal a mean score of 64.35 in the experimental class and 52.10 in the control class, a difference of 12.25 points. This suggests a notable improvement in the experimental group. The data were then analyzed using a normality test, as follows:

Table 6. Posttest Normality Test Results

Shaphiro-Wilk	***Statistic***	***df***	***Sig.***
Experimental	.790	20	.001
Control	.879	20	.017

Based on the normality test results of the posttest scores using SPSS, the significance values obtained were 0.017 for the control class and 0.001 for the experimental class. Since both significance values are less than 0.05, the null hypothesis (H0) is rejected. This indicates that the data from both classes are not normally distributed. Therefore, the analysis will proceed with the Mann-Whitney test with the following hypotheses:

H_0: $\mu 1 \leq \mu 2$ (The mathematical communication ability of MTs students taught using the Think Pair Share learning model is not better than that of students taught using conventional learning)

H_1: μ1 > μ2 (The mathematical communication ability of MTs students taught using the Think Pair Share learning model is better than that of students taught using conventional learning)

The results of the Mann-Whitney test are as follows:

Table 7. Mann–Whitney U Test Results – Posttest

Test Statistics[a]	
Mann-Whitney U	109,500
Wilcoxon W	319,500
Z	-2,454
Asymp. Sig (2- tailed)	,014

The significance value of 0.014 < 0.05 indicates H_0 is rejected, confirming that the mathematical communication skills of students taught using the Think Pair Share (TPS) model were significantly better than those in the control group. The analysis of students' improvement in mathematical communication skills was conducted using the N-Gain analysis. The first test performed was the Homogeneity Test, with the following hypotheses: H_0: $\sigma_1^2 = \sigma_2^2$ (the data variances are homogeneous), and H_1: $\sigma_1^2 \neq \sigma_2^2$ (the data variances are not homogeneous). The testing criteria used were: if the significance value (sign) is ≥ 0.05, then H_0 is accepted; if the significance value is < 0.05, then H_0 is rejected. The results of the Homogenity Test are as follows:

Table 8. Homogeneity Test – N-Gain Scores

Levene Statistics	**Df1**	**Df2**	**Sig.**
Eksperimental	1	38	.079

Based on the homogeneity test results using the SPSS application, the significance value for both classes was 0.079, which is greater than 0.05. This indicates that H_0 is accepted, meaning that the variance of the gain data is homogeneous. Subsequently, a normality test was conducted with the following results:

Table 9. Normality Test – N-Gain Scores

Shaphiro-Wilk	**Statistic**	**df**	**Sig.**
Experimental	.816	20	.002
Control	.890	20	.026

Based on the normality test results of the gain scores using SPSS, the significance values obtained were 0.026 for the control class and 0.002 for the experimental class. Since both significance values are less than 0.05, the null hypothesis (H_0) is rejected. This indicates that the data from both classes are not normally distributed. Therefore, the analysis will proceed with the Mann-Whitney test, with the results as follows.

Table 10. Mann–Whitney U Test – N-Gain

Test Statistics[a]	
Mann-Whitney U	105,500
Wilcoxon W	315,500
Z	-2,559
Asymp. Sig (2- tailed)	,010

Based on the output results, a significance value of 0.010 was obtained, which is less than 0.05. Therefore, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted, indicating that the average N-Gain score of the experimental class is significantly better than that of the control class. Furthermore, the mathematical communication ability of MTs students taught using the Think Pair Share learning model is superior to those taught using conventional methods. This finding is supported by student statements during interview, revealing that they find it easier to learn using the Think Pair Share model because it makes learning more enjoyable and provides greater freedom in thinking, discussing, and expressing solutions. These factors contribute to the improvement of students' communication abilities.

Discussions

Based on the findings of this study and the results of statistical tests, it was confirmed that the Think Pair Share (TPS) model had a significant effect on improving the mathematical communication skills of MTs students in the experimental class. This conclusion was supported by both the N-Gain analysis and the Mann–Whitney U test, which demonstrated that students who were taught using the Think Pair Share (TPS) model outperformed those who received conventional instruction. The study conducted by Hommy et al (2021) revealed that students instructed through the cooperative learning model Think Pair Share demonstrated significantly superior academic achievement compared to their counterparts who were taught using conventional instructional methods. This is in line with the research by (Setiawan & Cahyaningsih, 2023), which states that the Think Pair Share model is able to provide a positive impact or improve students' learning outcomes in Mathematics better than other learning models.

At the beginning of the learning process, students in both the experimental and control classes were given a pretest to assess their initial skills. Both groups received the same set of questions. After the pretest, the students participated in three learning sessions, during which they engaged in solving mathematical communication tasks. The control class continued with traditional instruction, while the experimental class applied the Think Pair Share (TPS) model to explore differences in the improvement of communication skills.

Initially, both classes encountered similar difficulties. The experimental class needed time to adjust to the new learning method. However, as the sessions progressed, students in the experimental group began to adapt and feel more comfortable with the Think Pair Share (TPS) approach. At the end of the intervention, both classes took a posttest, using the same questions. The posttest results showed a greater improvement in the experimental class, confirming that mathematical communication skills had improved significantly following the application of the Think Pair Share (TPS) model.

This finding is in line with the study by Purba & Rajagukguk (2024), which demonstrated the significant positive impact of the Think Pair Share (TPS) model on students' mathematical communication skills. The improvement is attributed to the structured stages of the Think Pair Share (TPS) model, which require students to interact, collaborate, and express their ideas clearly during both peer and whole-class discussions.

During the implementation of the Think Pair Share (TPS) model, student engagement increased noticeably. This was evident during the "pair" (discussion with a partner) and "share" (class presentation) stages. Students who were usually passive became more active due to the relaxed and supportive atmosphere of the discussions. Most students were enthusiastic when working with their partners on the learning worksheets (LKPD), and they actively shared their findings with the class. This engagement directly contributed to the development of their communication skills.

These observations are consistent with the findings of Jusniani & Nurmasidah (2021), who concluded that active learning methods can enhance students' mathematical communication abilities. In this study, the Think Pair Share (TPS) model encouraged students to speak, listen, and reflect on mathematical ideas in a more confident and collaborative environment.

The field observations also revealed that Think Pair Share increased student participation during class. The paired discussions gave students who lacked confidence a safer space to express their thoughts compared to speaking in front of the entire class. As a result, students became more motivated to participate. Furthermore, the "Think" stage allowed students to reflect on the material independently before discussing it with a partner, enabling them to solidify their understanding. The "Pair" stage helped students verify their understanding through dialogue, while the "Share" stage gave them the opportunity to express their ideas to the class. This progression supported students in developing a clearer understanding and greater confidence.

Students who had difficulty understanding certain concepts also benefited from their peers explanations, highlighting the cooperative nature of the Think Pair Share (TPS) model. This aligns with Arlina et al. (2023) who found that students were greatly supported through the Think Pair Share (TPS) learning model.

CONCLUSION

This study employed a Mixed Methods approach with an Explanatory Sequential Design and was conducted at an MTs (Islamic junior high school) located in the Padalarang region. It aimed to investigate the influence of the Think Pair Share (TPS) learning model on the mathematical communication skills of students.

The results indicated that students instructed through the Think Pair Share model exhibited significantly enhanced mathematical communication skills compared to their peers who experienced conventional teaching methods. This was reflected in the posttest scores, with the experimental group attaining a higher average than the control group. Additionally, the N-Gain analysis demonstrated a more substantial improvement within the experimental class.

These findings were further validated by students' responses in interviews, wherein they conveyed that learning via the Think Pair Share model was both more enjoyable and engaging. They experienced increased autonomy in thinking, discussing, and expressing their solutions. This elevated engagement subsequently facilitated the development of their mathematical communication skills.

Moreover, students in the experimental group attained mastery learning, further underscoring the efficacy of the Think Pair Share (TPS) model. These results suggest that the TPS model serves as an effective instructional approach for improving students' mathematical communication skills as well as their overall academic performance.

This study indicates that the Think Pair Share (TPS) model can be reliably implemented across diverse mathematical topics, providing educators with a versatile and effective strategy to enhance students' communication skills. Furthermore, the findings lay a groundwork for subsequent research, particularly for scholars seeking to explore comparable instructional models aimed at developing various competencies.

Future advancements of the Think Pair Share model may involve its incorporation with technological or digital learning resources, thereby enhancing the interactivity and effectiveness of the educational experience.

ACKNOWLEDGMENTS

The researcher would like to sincerely thank all those who contributed to the successful completion of this study. Special appreciation is extended to the principal of the MTs, the mathematics teacher, and the Grade VIII students, whose support and cooperation played a crucial role in facilitating the research and the preparation of this academic paper.

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